

Studies on Indian cercariae

I. Strigeoid cercariae*

A. S. MURTY**

Department of Zoology, Andhra University, Waltair 530003

MS received 15 November 1974

(Communicated by Prof. P. N. Ganapati, F.A.Sc.)

ABSTRACT

Three new species of strigeoid cercariae, viz., *Cercariae indicae* LXIII, LXIV and LXV are described. *C. indicae* LXIII and LXIV are pharyngeate, distomate, longifurcate furcocercous cercariae with respectively six and eight pairs of flame cells in the body. *C. indicae* LXV is a pharyngeate, monostomate, longifurcate furcocercous cercaria with eight pairs of flame cells in the body. *C. kumaunensis*, a cyathocotylid cercaria, is reported from Andhra Pradesh also. Suppression of the various sub-groups of cyathocotylid cercariae, which neither have any taxonomic validity nor indicate any phylogenetic relationship, is advocated.

INTRODUCTION

DURING the course of work on larval forms and life cycles of digenetic trematodes from Andhra Pradesh, India, eight species of snails, viz., *Melanoides tuberculatus* (Müller), *Indoplanorbis exustus* (Deshayes), *Amnicola travancorica* (Benson), *Lymnaea luteola* Lamarck, *L. acuminata* Lamarck, *Vivipara bengalensis* (Lamarck), *Pila globosa* (Swainson) and *Gyraulus convexiusculus* (Hutton) were collected and studied for trematode infections. During a period of two and half years of study, 39 species of cercariae were recorded of which 23 were found to be as yet undescribed. The present communication deals with the description of four strigeoid cercariae (La Rue 1957), of which three appear to be new. The new species are named as *Cercariae indicae* with serial numbers in continuation of those given by Sewell (1922).

* Part of a Ph.D. Thesis approved by Andhra University, Waltair.

** Present address: Department of Zoology, Andhra University Postgraduate Centre, Guntur 522005.

MATERIAL AND METHODS

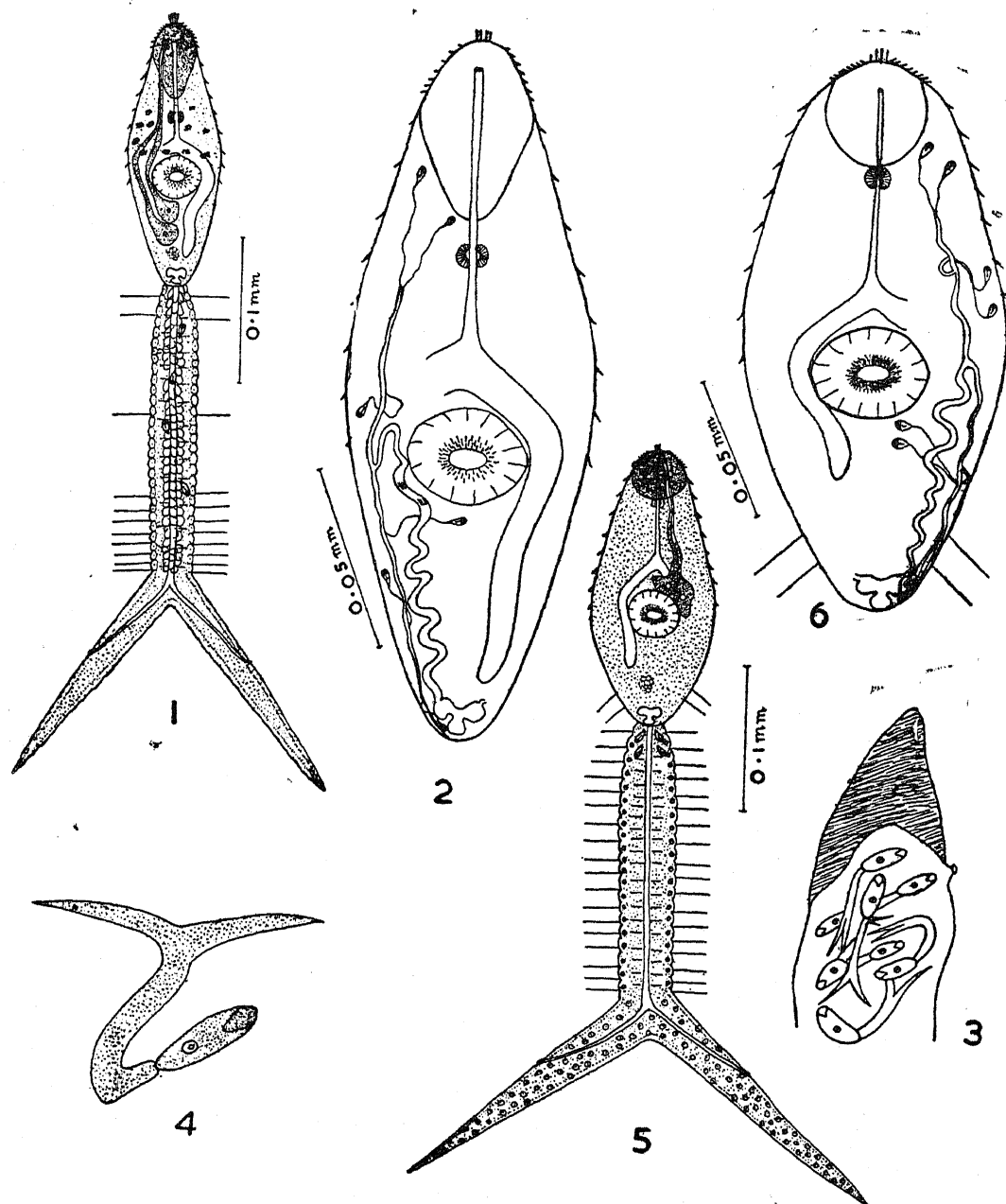
Collection and transportation of snails from the field were followed by their isolation in the laboratory in suitable containers. The snails were maintained in the laboratory on boiled, dried and powdered leaves of *Ipomea pes-capre* (Linn.) Sweet.

Only freshly emerged living cercariae were used for the study of the morphological and structural details. The incidence of emergence as advocated by Miller (1936) and not the incidence of infection is given. Neutral red, Bismarck brown, Janus green and methylene blue were used as intravital stains. Amphibian Ringer's solution, 0.9% saline and India ink were helpful in locating flame cells. Measurements are those of 10 heat killed cercariae, as recommended by Cable (1956), with the mean given in parentheses. Intramolluscan stages were measured under coverslip pressure, while alive. All measurements are in microns. Figures are camera lucida drawings.

OBSERVATIONS

*Strigeoid cercariae**Description of Cercariae**Cercariae indicae* LXIII sp. nov. (figures 1-4)

Furcocercous, body fusiform, broader than tail. Maximum width of body anterior to ventral sucker. Body spinose, spines at tip of anterior organ more prominent and directed forward. Following a circumoral spineless region, is an oral cap of 6 to 8 rows of concentrically arranged spines decreasing in size posteriad, extending up to two-fifths of length of the anterior organ. Following the oral cap of spines is a spineless region. Preacetabular body spination arranged in 7 to 8 rows. Orange yellow pigment patches lateral to pharynx, as well as anterior to ventral sucker. Tail longifurcate. Cuticle of the tail stem thrown into concentric rings. Eleven pairs of lateral bristles on tail stem. Numerous very small caudal bodies surrounding caudal excretory tubule, connected to cuticle by strands. Rami covered with spinulets. Ventral sucker post-equatorial. Three alternating rows of spines around opening of ventral sucker. Mouth sub-terminal; prepharynx small, pharynx muscular, oesophageal bifurcation preacetabular. Caeca undulating, extend up to the excretory bladder. Penetration glands two pairs, intercaecal and postacetabular, contents of glands finely granular. Excretory system mesostomate, bladder tripartite. Two ciliated patches in the main tubules. Anterior and posterior collecting tubules end in three flame cells each. Caudal excretory tubule bifur-



Figures 1-6. Figs. 1-4. *Cercariae indicae* LXIII sp. nov.: (1) Ventral view of the cercariat (2) Body of the cercaria showing arrangement of flame cells. (3) Sporocyst. (4) Cercaria at rest, in water. Figs. 5-6. *Cetcorioe indicoe* LXIV sp. nov.: (5) Ventral view of the cercaria. (6) Body of the cercaria showing arrangement of flame cells.

cates and opens laterally half way down the ramus. Flame cells in tail two pairs, asymmetrically arranged. Genital rudiment represented by a mass of cells between penetration glands and bladder.

Measurements: Body 164-200 by 52-68 (180 by 58). Tail stem 192-208 by 32-36 (203 by 33). Ramus 168-184 (176) by 20. Anterior organ 32-60 by 32-36 (53 by 33). Ventral sucker 28-32 by 32-36 (31 by 33). Pharynx 12 by 12.

A large number of cercariae emerge throughout the day. Periods of swimming alternate with periods of passive sinking and rest. Cercariae are distributed at all levels of container. While at rest, tail stem is bent at an angle one-fourth distance from base (figure 4).

Sporocyst: Liver and viscera of snail are packed with elongate, motile orange yellow sporocysts. Longest sporocyst recovered measured, 4,920 by 130. Birthpore a little behind the blunt end of sporocyst, guarded by a muscular sphincter. Cercariae in various stages of development. Development completed within sporocyst.

Snail host: *Limnaea acuminata* Lamarck

Locality: Kondakarla lake

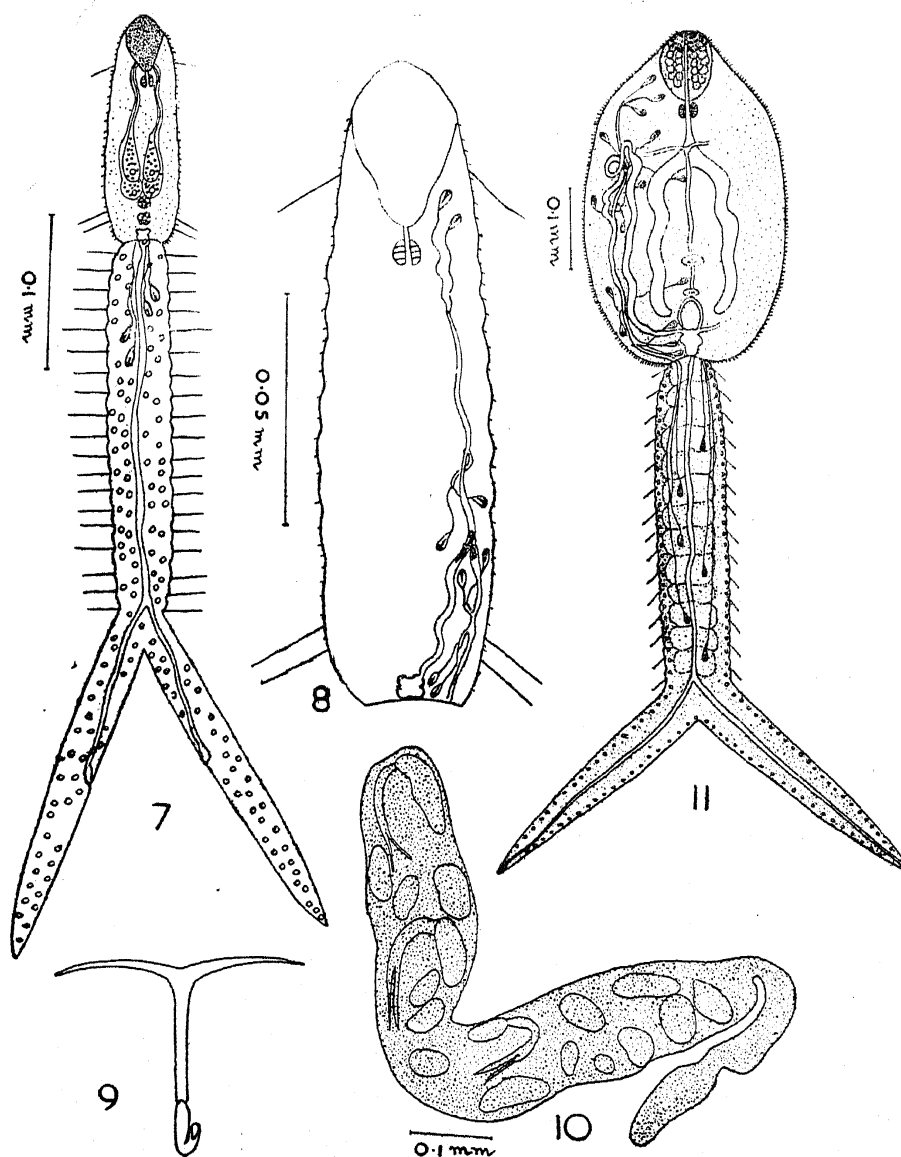
Incidence of emergence: 1 out of 118 snails in December 1965.

Relationship: Of all the described distomate, longifurcate furcocercous cercariae with two pairs of postacetabular penetration glands and lacking a finfold on rami and cross anastomosis between main excretory tubules, the following have six pairs of flame cells in body and two pairs in tail: Cercaria of *Diplostomum phoxini* (Faust 1918); *C. flexicauda* Cort and Brooks, 1928; *C. helvetica* XIII Dubois, 1929; *C. yogena* Cort and Brackett, 1937; *C. maritzbergensis* Porter, 1938; Cercaria of *Diplostomum barei eucaliae* Hoffman and Hundley, 1957; *C. laruei* Cort and Brooks, 1928; *C. murrayensis* Johnston and Cleland, 1938; *C. kumari* Singh, 1955; cercaria of *Diplostomum gasterostei* described by Williams (1966) and *C. paracauda* Iles, 1959. The present cercaria differs from these species in the relative lengths of body-tail stem and tail stem-rami. Further, cercaria of *D. phoxini*, *C. flexicauda*, *C. helvetica* XIII, *C. yogena*, *C. maritzbergensis* and cercaria of *D. barei eucaliae* have less number of caudal bodies than in the present species; *C. laruei* and *C. murrayensis* differ from the present species in the number of rows of spines around the opening of ventral sucker. *C. kumari* and cercaria of *D. gasterostei* are larger than the present species. In *C. paracauda* the rami are longer than tail stem, while the reverse is true in the present species.

Cercariae indicae LXIV sp. nov. (figures 5 and 6)

Furcocercous, body appears cylindrical while swimming and at rest, fusiform under coverslip with maximum width near ventral sucker. Body spinose, spination on anterior organ and body same as in previous species. Orange yellow pigment granules uniformly distributed all over body. Two pairs of lateral bristles on body anterior to bladder. Tail longifurcate. Cuticle of tail stem thrown into concentric rings. Eighteen pairs of uniformly spaced lateral bristles on stem. Caudal bodies absent. Ventral

sucker subequatorial bearing 3-4 rows of spines around opening. Sub-terminal mouth leads into pharynx. Oesophagus slender. Caeca extend half way between ventral sucker and bladder. Penetration glands two pairs, anterolateral to ventral sucker, first pair almost touch each other. Contents of glands finely granular. Openings of glands small and lateral to mouth. Excretory system mesostomate, bladder tripartite. Flame cell formula: $2 [(2 + 2) + (2 + 2) + 2] = 20$. Flame cells in tail situated very close to body. Caudal excretory tubule forks and opens laterally half way down on rami. Reproductive rudiment as in previous species.



Figures 7-11. Figs. 7-10. *Cercariae indicae* LXV sp. nov. : (7) Ventral view of the cercaria. (8) Body of the cercaria showing arrangement of flame cells. (9) Cercaria at rest, in water. (10) Sporocyst. Fig. 11. *Cercaria kumaunensis*, ventral view.

Measurements: Body 176–210 by 62–80 (198 by 75). Tail stem 176–200 by 32–40 (186 by 34). Ramus 200–240 by 16–24 (212 by 20). Anterior organ 32–40 by 24–40 (35 by 30). Ventral sucker 32–36 by 28–36 (33 by 30). Pharynx 16–22 (19) by 19.

A few hundred cercariae emerge throughout the daytime. While swimming, the cercaria looks like an oscillating rod with nodes at body-tail stem and tail stem-rami junction. Newly emerged cercariae hardly rest, but as time passes they frequently rest, hanging upside down with rami spread out at right angles to stem. Cercariae distributed at all levels in container. Two generations of sporocyst apparent. Longest sporocyst dissected out measured 5,000 by 100–150. Younger generation measured 1,800 by 50–115. Sporocysts containing only developing embryos. No fully developed cercariae inside sporocysts.

Snail host: *Lymnaea acuminata*

Locality: Kondakarla lake

Incidence of emergence: 1 out of 118 snails in December 1965.

Relationship: Of all the described distomate, longifurcate furcocercous cercariae with two pairs of penetration glands anterolateral to ventral sucker and lacking caudal bodies and cross anastomosis between main excretory tubules, only two other cercariae have 8 pairs of flame cells in body and two pairs in tail, viz., cercaria of *Hysteromorpha triloba* Lutz, 1931 described by Huggins (1954) and *C. samburgi* Goodman, 1951. The former differs from the present species in the possession of a distinct prepharynx and a tail stem longer than both body and rami, while the latter differs in the terminal opening of the excretory tubules on the rami.

Cercariae indicae LXV sp. nov. (figures 7–10)

Furcocercous, body cylindrical, sides almost parallel to each other. When contracted 6–8 annulations appear on body between anterior organ and penetration glands. Body spinulate, with a circumoral spineless area. Three pairs of lateral bristles on body. Tail stem aspinose, longer than, but as wide as, body. Twenty pairs of uniformly spaced lateral bristles on stem. Cuticle of stem annulated. Rami as long as stem. Anterior organ well developed. A weakly staining mass of cells posterior to penetration glands seems to be the only trace of ventral sucker. Mouth subterminal, small but distinct prepharynx. Pharynx small. Post-pharyngeal digestive system not developed. Two pairs of postequatorial penetration glands. Glands not very conspicuous; do not stain with neutral red, but ducts visible lateral to pharynx and open lateral to mouth.

Contents of glands coarsely granular. Excretory system mesostomate, bladder almost quadrangular with a slight median constriction. Ciliated patches in main tubules as well as anterior and posterior tubules. Flame cell formula: $2[(2+2) + (2+2) + 2] = 20$. Flame cells in tail asymmetrically arranged. An "Island of Cort" discernible at the origin of caudal tubule. The latter forks, opens laterally, halfway down on rami through flask-shaped dilations. Genital rudiment anterior to bladder.

Measurements: Body 125–156 by 34–45 (137 by 38). Tail stem 184–240 by 28–36 (207 by 32). Rami 192–240 by 16–24 (208 by 18). Anterior organ 26–36 by 16–24 (31 by 21).

Cercariae are shed during all hours of day, but maximum numbers emerge during morning. While at rest, cercaria hangs upside down with rami spread out and body bent in middle, resembling a hook (figure 9).

Sporocyst (figure 10): Pigmented and forms a tangled mass in snail liver. Longest sporocyst recovered measured 5,080. Smaller but complete sporocysts measured 1,066 by 108. Such smaller sporocysts might have been originally very long, but on release of cercariae might have shrunken as observed by Hoffman (1956) in the sporocysts of *Crassiphiala bulboglossa* Van Haitsma, 1925.

Snail host: *Indoplanorbis exustus* (Deshayes)

Locality: Kondakarla lake

Incidence of emergence: 1 out of 98 in December 1965.

Relationship: All described longifurcate, monostomate (*i.e.*, ventral sucker absent or represented by a mass of cells only), pharyngeate furcercous cercariae except *C. hornifurca* Singh, 1953 are reported to possess 3 pairs of penetration glands. The present species differs from *C. hornifurca* in the absence of unpigmented eye spots and in the number of flame cells.

Cyathocotylid cercariae

C. kumaunensis Singh and Malaki, 1963 (figure 11) Singh and Malaki (1963) described this cercaria from *Vivipara bengalensis* (Lamarck) from Uttar Pradesh, North India.

Measurements: Body 272–458 by 140–260 (372 by 168). Tail stem 380–480 by 60–92 (434 by 77). Rami 260–340 (304). Anterior organ 60–85 by 44–70 (69 by 53). Ventral sucker 20–28 (24) in diam.

Collection site: Creek behind Medical College, Kakinada, Andhra Pradesh.

Incidence of emergence: 1 out of 19 snails.

Remarks: Singh and Malaki (*op. cit.*) in their description mentioned that ventral sucker is posterior to tribocytique organ while the reverse is true.

Cyathocotylid cercariae have been included under several sub-groups, viz., vivax, tetis (Sewell, 1922); leptoderma (Faust, 1922); vivipara and tauiana (Szidat, 1933), several cyathocotylid cercariae possessing the characters of more than one sub-group are now known (Anderson, 1944; Maxon and Piquegnat, 1949; Anderson and Cable, 1950; Khan, 1960), thus warranting the suppression of all sub-groups and adaptation of a single group name, viz., cyathocotylid cercariae.

ACKNOWLEDGEMENTS

The author is grateful to Prof. K. Hanumantha Rao, Head of the Department of Zoology, Andhra University, Waltair, for his guidance, to Prof. P. N. Ganapati for his interest in this work and for his valuable suggestions in the preparation of the paper. Thanks are also due to the authorities of CSIR and UGC for financial assistance.

REFERENCES

- Anderson, D. J., Studies on *Cercaria szidati* sp. nov. a new furcocercous cercaria of the vivax type. *J. Parasit.* 30 264-268 (1944).
- Anderson, D. J. and Cable, R. M., Studies on the life-history of *Linstowiella szidati* (Anderson) (Trematoda: Strigeatoidea: Cyathocotylidae). *J. Parasit.* 36 395-410 (1950).
- Cable, R. M., Marine cercariae of Puerto Rico. *Sci. Survey Porto Rico and Virgin Is.* 16 491-577 (1956).
- Faust, E. C., Notes on larval flukes from China. *Parasitology*, 14 248-267 (1922).
- Hoffman, G. L., The life cycle of *Crassiphiala bulboglossa* (Trematoda: Strigeida), development of the metacercaria and cyst and effect on the final host. *J. Parasit.* 42: 435-442 (1956).
- Hughhins, E. J., Life-history of a strigeid trematode, *Hysteromorpha triloba* (Rudolphi, 1819). Lutz, 1931. II. Sporocyst through adult. *Trans. Amer. Microsc. Soc.* 73 221-236 (1954).
- Khan, D., Studies on larval trematodes infecting fresh water snails in London (UK) and some adjacent areas. Part VI. The cercariae of the vivax group and the life-history of *Cercaria bushiensis* n. sp. (*Cyathocotyle bushiensis* n. sp.). *J. Helminth.* 36 67-94 (1962).
- La Rue, G. R., The classification of Digenetic Trematoda: A review and a new system. *Exptl. Parasit.* 6 306-49 (1957).
- Maxon, M. G. and Piquegnat, W. E., Cercariae from upper Newport Bay. *J. Ent. Zool.* 41 30-35 (1949).

- Miller, E. L., Studies on North American Cercariae. *Illinois Biol. Monogr.* 14 1-125 (1936).
- Sewell, R. B. S., Cercariae indicae. *Ind. J. Med. Res.* 10 (Suppl.), 1-371 (1922).
- Singh, K. S. and Malaki, A., Parasitological survey of Kumaun region. Part XVIII. One known and two new cercariae from freshwater snails. *Ind. J. Helminth.* 15 54-69 (1963).
- Szidat, L., Uber drei neue monostome Gabelschwanzcercarien der Ostpreussischen Fauna. *Z. f. Parasitenk* 5 443-459 (1933).
- Williams, M. O., Studies on morphology and life cycle of *Diplostomum* (*Diplostomum*) *gasterostei* (Strigeida: Trematoda). *Parasitology* 56 693-706 (1966).

